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Fırat Bilgel* and Burhan Can Karahasan**

Abstract

This study seeks to estimate the economic effects of PKK terrorism in Turkey in a causal framework. We create a synthetic control group that reproduces the Turkish real per capita Gross Domestic Product (GDP) before PKK terrorism emerged in the second half of the 1980s. We compare the GDP of the synthetic Turkey without terrorism to the actual Turkey with terrorism for the period 1955-2008. Covering the period of 1988-2008, we find that the Turkish per capita GDP would have been higher by an average of about $1,585 per year had it not been exposed to PKK terrorism. This translates into an average of 13.8 percent higher per capita GDP or a 0.62 percentage points higher annual growth over a period of 21 years. Our estimate is robust to country exclusion, sparse controls, various non-outcome characteristics as predictors of GDP, alternative specifications of the in-space placebo experiments and to other potentially confounding interventions to the sample units in the pre-terrorism period.

Keywords: separatist terrorism, synthetic control, Turkey, economic development, Causal Inference

JEL Codes: C15, D74, P59

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Thirty Years of Conflict and Economic Growth in Turkey: A Synthetic Control Approach

1. Introduction

Political conflict and economic development are inter alia related and they have been on the agenda of social scientists for decades. Among different dimensions of political conflict, separatist terrorism and its various effects on the socioeconomic environment receive continuous interest not only among political scientists but also economists. While the direct impact of terrorism on the distribution of public funds towards relatively low productive sources such as military spending is a concern, there are other channels through which terrorism may impair a nation's economic development. The loss of active population due to military conscription, rising uncertainty that discourages both external and internal economic actors, declining tourism revenues due to rising security concerns and the loss of industry-specific developments are the major repercussions at the macroeconomic level.

Turkey is a country that suffers from these effects of separatist terrorism. Separatist terrorism and the associated political conflict is one of the critical disputes of the Turkish Republican Era, dating back to the establishment of the Kurdistan Workers' Party (PKK) in 1978. PKK had its first instances of insurgency in 1984 in Eruh and Şemdinli in the Southeast region of Turkey. The low number of incidences during the emergence period became more pronounced as records show that from 1988 and onwards, PKK increased the extent and the frequency of its attacks[1]. It is estimated

[1] See Kayaoğlu (2014) and Bilgel and Karahasan (2015) for a brief overview of the history of PKK insurgency.

that between 1987 and 2015, about 4,300 civilians and 6,850 security force members and military personnel were killed by PKK terrorist activities.

An important dimension of PKK and separatist terrorism in Turkey is rooted in underdevelopment. The geographic roots of PKK terrorism emanates from the Eastern and Southeastern Anatolia, representing a cluster of historically underdeveloped regions that inhabit a significant Kurdish population. The historical evolution of regional gaps indicates that there are sizable differences in terms of the region's ability to use major public and private resources (Doğruel and Doğruel, 2003; Karaca, 2004; Gezici and Hewings, 2004; Gezici and Hewings, 2007). The east-west dichotomy in Turkey is so persistent and policy-insensitive that it brings out the concerns for an endogenous relationship between the causes and the consequences of PKK Terrorism. PKK terrorism emerges from a set of initially disadvantageous and less developed regions, creating an underdevelopment-enforcing cyclic causal pattern during the last three decades.

At the outset, the impact of terrorism at the regional scale is imminent. While Öcal and Yıldırım (2010) measures the direct impact of terrorism on regional growth by constructing a regional growth model, Bilgel and Karahasan (2015) shows some evidence for this prediction by focusing on a set of eastern and southeastern provinces in Turkey and finds that the region could have enjoyed a much higher level of economic prosperity in the absence of separatist terrorism. However, even at face value, the significance of the impact may be even higher due to persistence and spillover effects, reaching well beyond the physical and non-physical boundaries of the region. This suggests that terrorism may have additional detrimental effects, not only on the region's but also on the nation's economy.

To fill this gap, we aim to reveal the causal effect of terrorism on economic development in Turkey by imputing the missing potential outcome, that is the (counterfactual) outcome that would have prevailed if Turkey had not been exposed to PKK terrorism. For this purpose, we invoke the synthetic control method, developed by Abadie and Gardeazabal (2003), Abadie et al. (2010) and Abadie et al. (2015). We create a synthetic control group that reproduces the economic characteristics of Turkey before the PKK terrorism emerged in the second half of the 1980s by using the linear convex combination of countries that were not exposed to or not affected by terrorism. We then compare the real per capita GDP of the synthetic Turkey without terrorism to the actual Turkey with terrorism for the period 1955-2008. Extended over a period of 21 years (1988-2008), we find that the Turkish real per capita GDP declined on average by about 12.1 percent relative to a comparable synthetic Turkey in the absence of terrorism. This amounts to an average loss of about $1,585 ($874 in terms of 1990 Gheary-Khamis international dollars) or 0.58 percentage point lower annual growth, over a period of 21 years. Our study contributes to the discussions of the impact of political conflict on economic development from various angles. Early studies that investigated the impact of terrorism on economic prosperity using the synthetic control method were confined to relatively more prosperous countries[2]. Ideological matters seem to be more dominant in these cases over those that originate on the account of differences in economic development. However for the Turkish case, there exists a deep deliberation about the terror-prosperity link as PKK terrorism is historically rooted in the least developed parts of Turkey. To the best of our knowledge, Bilgel and Karahasan (2015) is the first to assess the impact of PKK separatist terrorism using counterfactuals; they consider the impact at the regional scale for the 1975-2001 period due to regional data constraints. We advance this assessment towards the national level to measure the overall impact of terrorism accurately and to account for the post-2001 period during which Turkey witnessed remarkable changes in its social and economic life and a paradigm shift in terrorism and security issues.

[2] See Abadie and Gardeazabal (2003) for Spain and Dorsett (2013) for Northern Ireland.

From a methodological perspective, we employ an exhaustive analysis using the synthetic control method, starting with the construction of a group of control countries whose weighted linear combination yields a good and valid approximation to the pre-terrorism per capita GDP values of our treated unit. For this purpose, we first estimate the propensity score to restrict our donor pool to countries with similar observable characteristics. Once the counterfactual Turkey (without terrorism) is imputed, we assess the robustness of our estimate using several checks consisting of (1) an iterative estimation of the synthetic or counterfactual Turkey by excluding one weight-assigned country at each iteration (i.e. leave-one-out synthetic control); (2) the use of alternative pre-terrorism characteristics as predictors of GDP; (3) exclusion of the treated unit from the control group of countries in the placebo test to assess the causality of the counterfactual outcome; (4) using a smaller number of control countries to examine the trade-off between sparsity and goodness of fit (i.e. sparse synthetic controls) and (5) an assessment of the consequences of other interventions to the treated unit in the pre-intervention period. Finally, as conventionally used to solve problems that have a probabilistic interpretation, we employ a Monte Carlo experiment to approximate the expected value of the causal effect by taking the empirical mean of repeated random samples.

Section 2 presents a brief overview of the related literature that focuses on the economic effects of particular terrorist organizations as well as those that employed our chosen methodology, the synthetic control. Section 3 presents the theoretical framework and the intuition behind the synthetic control method; rationalizes the choice of the dataset and the criteria in the selection of potential control countries that constitute our donor pool. Section 4 presents the results and performs a battery of robustness checks. Section 5 assesses the validity of our inference with respect to a number of potential threats. Section 6 discusses the possible effects of the post-2009 cease-fire attempts and the paradigm shift in terrorism and security issues. Section 7 concludes.

2. Prior literature

There has been an emerging empirical literature on the economic effects of particular terrorist organizations and specific cases of political violence. Notable examples include Fuerzas Armadas Revolucionarias de Colombia (FARC) in Colombia (Holmes et al., 2007), the Israeli-Palestinian Conflict (Eckstein and Tsiddon, 2004; Persitz, 2007), Taliban in Pakistan (Ahmed et al., 2012; Fatima et al., 2014; Gul et al., 2010; Hyder et al., 2015; Mehmood, 2014), Euskadi Ta Askatasuna (ETA) in Spain (Barros et al., 2006; Buesa et al., 2007; Colino, 2012; Colino, 2013) and Kurdistan Workers' Party (PKK) in Turkey (Özsoy and Sahin, 2006; Feridun and Sezgin, 2008; Araz-Takay et al., 2009; Öcal and Yıldırım, 2010; Derin-Güre, 2011; Feridun, 2011; Kayaoğlu, 2014). For a deeper and extensive discussion of the causes and consequences of terrorism in general, we refer the reader to Sandler and Enders (2008) and Krieger and Meierrieks (2011).

There is also a thin strand of research series that uses the synthetic control method to identify the causal effects of political armed conflict. In their seminal paper, Abadie and Gardeazabal (2003) applies the synthetic control method to ETA violence in Spain and estimate a reduction of about 10 percent in per capita GDP relative to the synthetic Basque region. A similar causal effect was found by Dorsett (2013) for the Irish Republican Army (IRA) in Northern Ireland and by Horiuchi and Mayerson (2015) for the second intifada under the Israeli-Palestinian conflict. The largest causal effect of 58 percent on GDP was reported by Almer and Hodler (2015) for the Rwandan genocide. Finally, Bilgel and Karahasan (2015) estimates the causal impact of PKK terrorism in the Eastern and Southeastern provinces of Turkey. Over a post-terrorism period of 14 years, the real per capita GDP in the Eastern and Southeastern Anatolia declined by about 6.6 percent relative to a comparable synthetic Eastern and Southeastern Anatolia without terrorism[3].

While violence and terrorism have detrimental effects regardless of the origin and the location, the nature of the terrorism can be quite divergent. The Turkish experience with separatist PKK terrorism during the last three decades shows some peculiarities given Turkey's geographic location and the persistence of inequalities between different segments of the society. This raises the concern for an endogenous relationship between terrorism and economic development. Feridun and Sezgin (2008) underlines that income and underdevelopment differences are important determinants of the propagation of violence in the southeastern geography of the country. In contradiction, there is a lack of a causal relationship between economic conditions of southeastern Turkey and separatist terrorism (Derin-Güre, 2011). Araz-Takay et al. (2009) goes a step further and states that the relationship is better represented by taking into account the possible non-linearities between terrorism and economic development; that is terrorism has severer effects during expansionary periods and that a decline in economic activity breeds terrorism only in recessionary periods. Öcal and Yıldırım (2010) underlines that regional heterogeneity matters and that the impact of terrorism becomes more pronounced for eastern and southeastern Turkey once regional growth patterns are considered. From a similar regional setting but a completely different methodology, Bilgel and Karahasan (2015) offers a solid approach to overcome the possible endogeneity embedded in the relationship between separatist terrorism and economic

[3] There are other studies that examine the impact of counter-terrorist efforts. Castañeda and Vargas (2012) asserts that the response of financial markets, measured by sovereign risk perception, is found to be idiosyncratic to political events against FARC in Colombia. Singhal and Nilakantan (2012) reports that 16 percent of the per capita net state domestic product in the state of Andra Pradesh in India is regained as a result of the efforts of counter-terrorist police force trained against Naxalite violence.

development in Turkey. While the synthetic control approach may have enabled to identify the true cost, their findings are local and restricted to a particular region. We conjecture that the economic costs of PKK terrorism, once grounded at the national level, will be substantially larger compared to that reported by Bilgel and Karahasan (2015), allowing us to discuss further the extent of PKK terrorism as it may well spread beyond Eastern and Southeastern regions of Turkey.

3. Synthetic Control Method

Suppose there are $C+1$ countries, indexed by $i=1,2,\ldots,C+1$ over T periods, $t=1,2,\ldots,T$. Only country $i=1$ was stricken by terrorism and the remaining C are the control countries, called the donor pool. There are T_0 number of pre-terrorism periods and T_1 number of post-terrorism periods so that $T_0+T_1=T$. The effect of PKK terrorism for unit i at time t is given by $\alpha_{it}=Y_{it}^{I}-Y_{it}^{N}$ where Y_{it}^{I} is the real per capita GDP of unit i if terror outbreaks in T_0+1 to T and Y_{it}^{N} is the real per capita GDP in the absence of terrorism. Since only country $i=1$ was exposed to terrorism, we need to estimate $(\alpha_{1T_0+1},\ldots,\alpha_{1T})$. We first estimate Y_{it}^{N} by the following factor model:

$$Y_{it}^{N}=\delta_t+\theta_t Z_i+\lambda_t\mu_i+\varepsilon_{it} \qquad (1)$$

where δ_t is an unknown common factor invariant across units, Z_i is the covariate vector not affected by terrorism, θ_t is a vector of unknown time-specific parameters, λ_t is a vector of unknown common factors, μ_i is the country-specific unobservable and the error term ε_{it} are the zero-mean transitory shocks.

The method aims to construct the missing counterfactual, Y_{it}^{N}, from countries not affected by terrorism. Let $W = (w_2, \dots, w_{C+1})'$ be $(C \times 1)$ vector of weights such that $0 \le w_j \le 1$ for $j = 2,3, \dots, C+1$ and $\sum_{j=2}^{C+1} w_j = 1$. Define the linear combination of pre-terrorism real per capita GDP values by $\bar{Y}_j^k = \sum_{m=1}^{T_0} k_m Y_{jm}$. Abadie et al. (2010) shows that if the following conditions hold, then the estimate of the effect of separatist terrorism in Turkey, $\hat{\alpha}_{1t} = Y_{1t} - \sum_{j=2}^{S+1} W_j^* Y_{jt}$, is an unbiased estimator of α_{1t}

$$\sum_{j=2}^{S+1} w_j^* Z_j \;\; \wedge \;\; \sum_{j=2}^{S+1} w_j^* \bar{Y}_j^K = \bar{Y}_1^k \qquad (2)$$

where w_j^* is the weight assigned to the j^{th} unexposed country.

The vector W^* is chosen to minimize the distance between the vector of pre-terrorism characteristics of Turkey (X_1) and the weighted matrix that contains the pre-terrorism characteristics of unexposed countries (X_0) : $\|X_1 - X_0 W\| = \sqrt{(X_1 - X_0 W)' V (X_1 - X_0 W)}$ where V is a symmetric and positive semidefinite matrix. This minimization procedure is subject to the constraints that the weight assigned to each unexposed country should lie between zero and one and that the sum of the weights is bounded by one. The weights are assigned to countries in the donor pool in such a way that the pre-terrorism real per capita GDP and the covariates that are thought to influence GDP are comparable to those of Turkey before the outbreak of terrorism. This comparability is determined by the minimization of root mean square prediction error (RMSPE) in the pre-terrorism period, which measures the lack of fit between the trajectory of the outcome variable and its synthetic counterpart (Abadie et al., 2015)[4].

[4] The pre-terrorism RMSPE is $\left(\frac{1}{T_0}\sum_{t=1}^{T_0}\left(Y_{1t} - \sum_{j=2}^{s+1} w_j^* Y_{jt}\right)^2\right)^{1/2}$ and the post-terrorism RMSPE is $\left(\frac{1}{T_1}\sum_{t=T_0+1}^{T_1}\left(Y_{1t} - \sum_{j=2}^{s+1} w_j^* Y_{jt}\right)^2\right)^{1/2}$ where T_0 and T_1 are the number of pre- and post-terrorism periods respectively, $w_j^* Y_{jt}$ is the synthetic outcome using the j^{th} unexposed country with weight w^* and Y_{1t} is the actual outcome of the treated country.

Along the lines of Bilgel and Karahasan (2015), we reproduce the pre-terrorism real per capita GDP trajectory of Turkey by some linear combination of the real per capita GDP of the control countries for every year in the pre-terrorism period[5].

3.1 Data and sample

We use country-level panel data on per capita GDP (1990 Geary-Khamis international dollars) provided by the Maddison Project[6]. There are other databases available for our analysis in the selection of the sample period and the number of countries. The first one is provided by the Penn World Tables (PWT) for the period 1950-2011 and contains 62 countries. The second dataset is provided by the World Bank (WB) for the period of 1960-2014 and contains 90 countries. The third dataset is provided by the United Nations Conference on Trade and Development (UNCTAD) for the period of 1970-2014 and contains 170 countries. While the PWT database has the largest number of pre-terrorism periods (38 years), it also has the smallest number of potential control units. On the other hand, the UNCTAD database has a smaller number of pre-terrorism periods (18 years) but has the largest pool of potential control units. To keep as many potential control units as well as many pre-treatment periods as possible in our sample, we opt to use the Maddison Project database. It contains GDP information on 135 potential countries and our treated unit, Turkey, for the period 1955-2008[7]. Given the year of intervention for the treated unit (Turkey, 1988), this yields a pre-terrorism period of 33 years and a post-terrorism period of 21 years[8].

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[5] See section 5.1 for an alternative set of predictors that does not involve all pre-intervention values of the outcome to construct the synthetic control unit.
[6] The Maddison-Project, http://www.ggdc.net/maddison/maddison-project/home.htm, 2009 version.
[7] The GDP data in the most recent version of the Maddison project is extended until 2010. However, we did not extend our sample period because of lack of data for most of the countries in our sample.
[8] The first PKK incidence is recorded in 1984; however, between 1984 and 1988, PKK incidences displayed a discontinuous structure. After 1988, there has been a stable increase in the number of incidences; therefore we assign 1988 as the intervention year.

3.2 Constructing the Donor Pool

One of the necessary conditions of the synthetic control method to correctly isolate the impact of separatist terrorism on the nation's GDP is that the control units should not have been affected by significant and sustained terrorist activities. To meet this requirement, we screened the Global Terrorism Database (GTD) to identify countries that were exposed to terrorist activity throughout the sample period[9]. Our exclusion criteria from the donor pool involves severe terrorist activity characterized by the high number of deaths and injured and sustained terrorist activity characterized by long periods of terror events, devastating enough to affect the national economy. Table 1 shows a list of 53 countries, excluded from the donor pool and the prominent terrorist organizations operating in each country. The donor pool consists of 82 control countries after dropping those that are significantly and sustainably affected by terrorism.

Another step in correctly estimating the causal effect of an intervention on the outcome variable is to select a number of control units in such a way that the covariates that are thought to affect the outcome variable are comparable to those of the treated unit in the pre-intervention period. For the fact that the synthetic control estimates are based on a linear model, the donor pool has to be restricted to countries with similar observable characteristics in order to yield a good approximation (Dhungana, 2011). The challenge is that the assignment of the units to treatment and control groups is not random in observational studies and therefore the imputation of the missing counterfactual or the potential outcome becomes complicated because of selection bias. Without restricting the donor pool to countries with similar observables, the treatment effect will be biased by the presence of confounders. Even though the synthetic control method reproduces the

[9] Global Terrorism Database (GTD): http://www.start.umd.edu/gtd/

outcome trajectory of the treated unit in the pre-intervention periods by some linear combination of the covariates of the unaffected control units without allowing any extrapolation, the method will not necessarily yield a good fit in the pre-intervention period if forced to assign weights to some control units that are highly dissimilar because they have been misleadingly kept in the donor pool. The consequence is that the causal effect will be biased due to selection and confounders and inference will be invalid. To deal with this problem, we estimate the propensity score of Rosenbaum and Rubin (1983) to further restrict the donor pool to countries with similar observable characteristics prior to invoking the synthetic control. This method summarizes the pre-intervention characteristics of each potential control unit into a single-index variable (i.e. the propensity score) to help reduce bias in the subsequent "matching" procedure of the synthetic control. Propensity score is used solely to reduce the dimensions of the conditioning; it is not associated with behavioral assumptions (Dehejia and Wahba, 2002). It is important to note that our aim at this stage is not identifying any treatment effect but simply restricting the donor pool to countries with similar observable characteristics by the virtue of some similarity measure[10].

Table 1: Notable terrorist groups and countries excluded from the donor pool

Country	Terrorist Organization
Afghanistan/Pakistan	Taliban
Algeria	Islamist Extremists
Angola/Namibia	National Union for the Total Independence of Angola
Argentina	Montoneros
Bangladesh	Shanti Bahini
Burma	Karen National Union
Burundi/Rwanda	Hutus/Tutsi

[10] We alternatively employed the coarsened exact matching of Iacus et al. (2011) and Iacus et al. (2012) prior to performing the synthetic control. Coarsened exact matching temporarily coarsens each covariate to be included in the matching process and applies an exact matching algorithm to the coarsened variable to determine the matches and prune unmatched observations from the data (assigns binary weights of zero or one). A drawback of the method in our context is that, the coarsened exact matching assigns binary weights to a number of countries in the donor pool such that they all have lower real per capita GDP than that of Turkey. This matching outcome implies that the convex-hull criteria of the synthetic control method cannot be satisfied and the resulting pre-terrorism fit will be extremely poor.

Cambodia	Khmer Rouge
Cameroon/Nigeria	Boko Haram
Colombia	Revolutionary Armed Forces of Columbia (FARC)
Dem. Rep. of Congo/Uganda	Lord's Resistance Army (LRA)
Djibouti	Front for the Restoration of Unity and Democracy
El Salvador	Farabundo Marti National Liberation Front (FMLN)
Greece	Revolutionary Popular Struggle (EA)
Honduras	Lorenzo Zelaya Revolutionary Front
India	Naxalites
Indonesia	Jemaah Islamiya
Iran	Jundallah
Iraq	Islamic State of Iraq and the Levant (ISIL)
Ireland/UK	Irish Republican Army (IRA)
Italy	Armed Revolutionary Nuclei (NAR)
Kenya/Somalia/Eritrea & Ethiopia	Al-Shabaab
Lebanon	Hizbullah
Mexico	Narcoterrorist groups
Mozambique	Mozambique National Resistance Movement (MNR)
Nepal	Communist Party of Nepal – Maoists
Nicaragua	Northen Diriangen Front (FND)
Peru	Shining Path (SL)
Philippines	Abu Sayyaf Group/New People's Army
South Africa	Inkatha Freedom Party (IFP)
Spain	Euskadi Ta Askatasuna (ETA)
Sri Lanka	Liberation Tigers of Tamil Eelam
Sudan	Janjaweed
Yemen	Al-Qa'ida

Note: In addition to the above list, the following excluded countries are exposed to severe and sustained terrorist activity during the sample period yet were not dominated by a particular prominent terrorist group: Albania, Guatemala, Chad, Egypt, Haiti, Israel, Libya, Niger, Syria, Thailand, West Bank & Gaza.

The propensity score is defined as the probability of receiving the treatment conditional on the pretreatment characteristics (Rosenbaum and Rubin, 1983):

$$p(X) = Pr(D = 1|X) \tag{3}$$

where $D \in \{0,1\}$ is a binary indicator that takes the value of one for treatment and zero for control units and X is the covariate vector.

The balancing hypothesis states that the treatment D is orthogonal to the covariate vector X, conditional on the propensity score:

$$D \perp X|p(X) \tag{4}$$

The ignorability/unconfoundedness assumption states that if treatment D is orthogonal to potential outcomes $Y(0), Y(1)$, conditional on the covariate vector X, it must follow that D is also orthogonal to potential outcomes $Y(0), Y(1)$, conditional on the propensity score:

$$D \perp \{Y(0), Y(1)\}|X \Longrightarrow D \perp \{Y(0), Y(1)\}|p(X) \tag{5}$$

We estimate the propensity score by fitting the following logit model:

$$Pr(D_i = 1|X_i) = \Phi\{h(X_i)\} \tag{6}$$

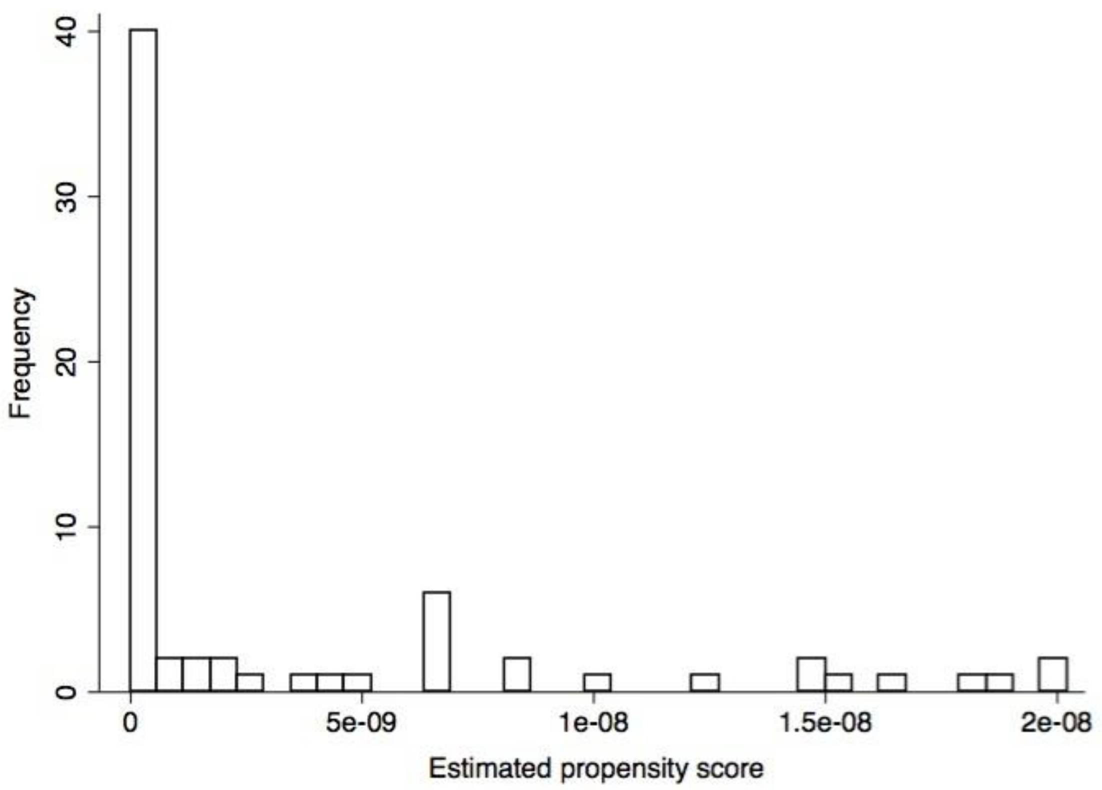
where Φ denotes the logistic cumulative distribution function and $h(X_i)$ is the specification that includes the pretreatment characteristics in linear terms. We use per capita GDP of the control units for every year in the pre-terrorism period as the pretreatment characteristics. We then split the sample into k equally spaced intervals of the propensity score[11]. The balancing hypothesis requires that the pretreatment characteristics should not differ between the treated and control units within each interval.

Figure 1 displays the distribution of propensity scores after the balancing property is satisfied. Based on the distribution given in figure 1, we trim the first 40 countries that are located farthest from our treated unit in terms of the propensity score in

[11] We use the pscore command in Stata (Becker and Ichino, 2002).

order to restrict the donor pool to those that are relatively similar to our treated unit. Our final donor pool to be used in the synthetic control consists of 42 countries: Austria, Bolivia, Brazil, Bulgaria, Canada, Cape Verde, Chile, China, Comoros, Dominican Republic, Gabon, Ghana, Hong Kong, Hungary, Ivory Coast, Jamaica, Kuwait, Liberia, Mauritius, New Zealand, North Korea, Norway, Oman, Panama, Poland, Qatar, Romania, Sao Tomé and Principe, Saudi Arabia, Senegal, Seychelles, Sierra Leone, South Korea, Swaziland, Taiwan, Tanzania, Tunisia, United Arab Emirates, Uruguay, United States, Venezuela and Vietnam.

Figure 1: Distribution of the propensity score



4. Results and Inference

Figure 2 plots the trends in real per capita GDP for Turkey and its synthetic counterpart over the period 1955–2008 with a pre-terrorism period of 33 years. The synthetic GDP trajectory is constructed by using the convex combination of countries in the donor pool that closely resembled Turkey before the outbreak of terrorism (see table 2)[12]. The synthetic per capita GDP trajectory well reproduces the actual GDP trajectory in the pre-terrorism period. The goodness-of-fit in the pre-terrorism period measured by the RMSPE is 44.69.

Table 2: Synthetic Control Country Weights, Turkey

Country	Weight
Bolivia	0.098
Comoros	0.019
Gabon	0.026
Hungary	0.013
Mauritius	0.075
Oman	0.058
Poland	0.034
Qatar	0.001
Romania	0.121
Senegal	0.122
South Korea	0.268
Swaziland	0.081
Taiwan	0.012
Venezuela	0.073

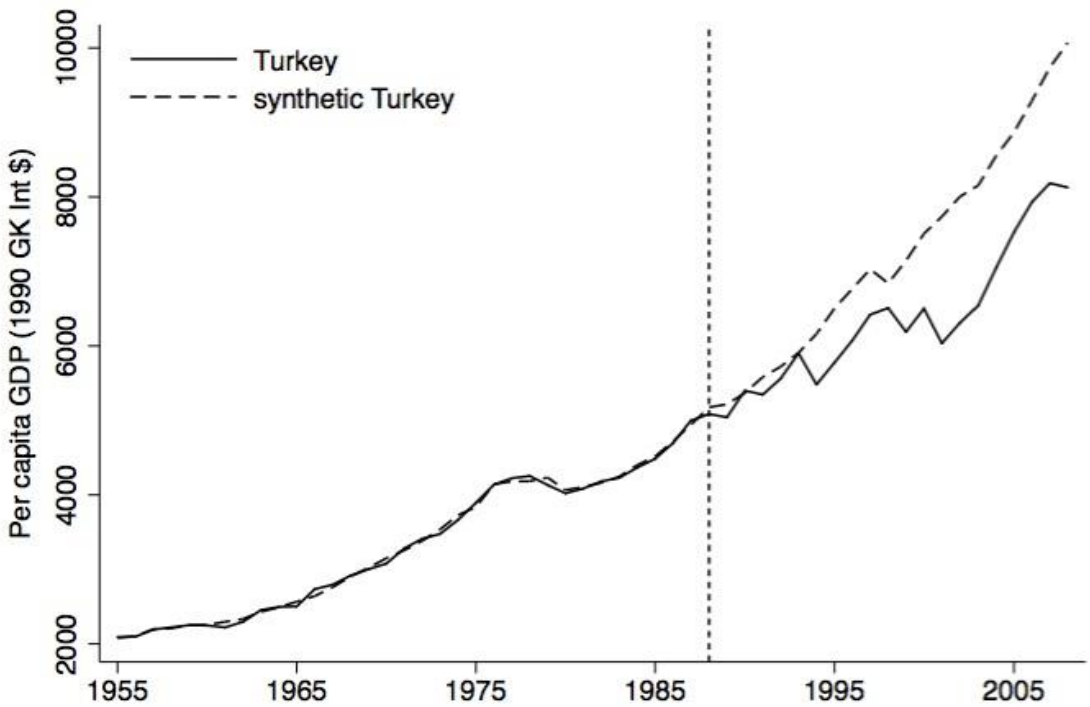
Source: Authors' own calculations.

While the actual and the synthetic trajectories are close to each other in the next six years following the emergence of PKK terrorism, the gap widens over the 1994-2008 window. The estimate of the impact of terrorism is given by the difference between the actual and the synthetic per capita GDP in the post-terrorism period. Our findings suggest that in the post-terrorism period, the real per capita GDP in Turkey

[12] We use the synth command in Stata, found at: http://www.stanford.edu/~jhainm/synthpage.html

decreased by about 12.1 percent on average relative to a comparable synthetic Turkey in the absence of terrorism[13]. In other words, Turkey could have enjoyed a 13.8 percent higher GDP had the country not been exposed to terrorism.

Figure 2: Trends in per capita GDP: Turkey vs. Synthetic Turkey



4.1. In-space Placebo Studies

In order to ensure that a particular synthetic control estimate reflects the impact of terrorism (i.e. the synthetic controls provide good predictors of the trajectory of real per capita GDP in the pre-terrorism period), we perform in-space placebo test, in which each of the 42 countries which were not affected by terrorism are artificially reassigned as if they have been exposed to PKK terrorism in 1988 and shift Turkey

[13] This causal effect is calculated by taking the ratio of the difference between the average real per capita GDP of Turkey and the average real per capita GDP of the synthetic Turkey to the average real per capita GDP of the synthetic Turkey in the post-terrorism period.

into the donor pool (Abadie et al., 2010)[14]. If a particular country was affected by terrorism and others were not, we expect the control countries subject to the synthetic control to be unaffected by terrorism. Thus we should not observe actual and synthetic real per capita GDP diverge in the post-terrorism period. Our confidence that a sizeable synthetic control estimate reflects the effect of terrorism would be severely undermined if similar or larger estimated GDP gaps are obtained when terrorism is artificially assigned to countries that were not affected by terrorism (Abadie et al., 2010).

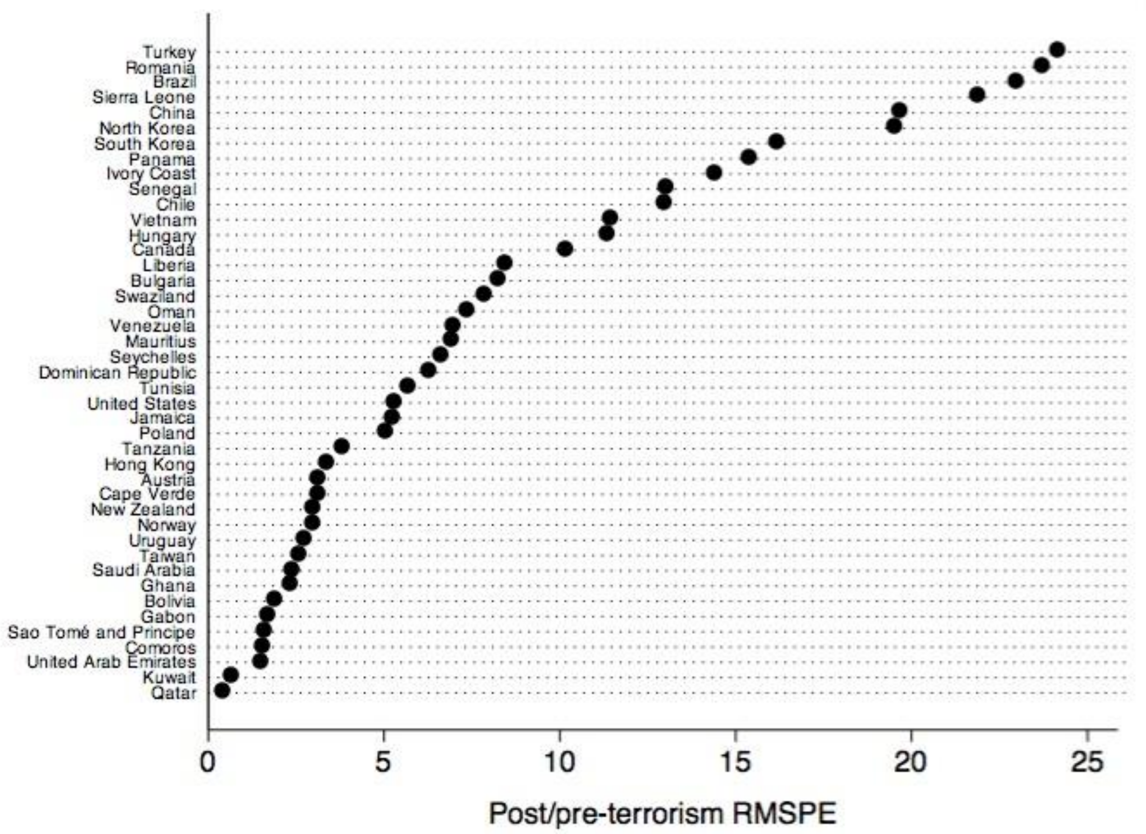
In order to assess the causality of the estimated effect, the synthetic control method is applied to estimate in-space placebo GDP gaps for every potential control country in order to create a distribution of placebo effects. This distribution enables us to identify the exact significance level of the estimated effect of terrorism. Our confidence that a sizeable synthetic control estimate reflects the effect of the terrorism would be severely undermined if the estimated gap fell well inside the distribution of placebo gaps (Abadie et al., 2010). This would imply some randomness rather than the causality of the effect. The estimated effect of terrorism in Turkey is evaluated by calculating the ratio of post-terrorism RMSPE to pre-terrorism RMSPE that are equal to or greater than the one for Turkey. This ratio is the p-value that can be interpreted as the probability of obtaining a post/pre-terrorism RMSPE that is at least as large as the one obtained for Turkey when terrorism is artificially and randomly reassigned to a country that was not affected by terrorism.

Figure 3 plots the values of the post/pre-terrorism RMSPE for Turkey and for all 42 countries in the donor pool. The estimated real per capita GDP gap fell outside the

[14] Ando and Sävje (2013) argues that since we expect the treated unit to be affected by the intervention, including it as a control unit in the placebos cannot necessarily construct the counterfactual outcome. We repeat the placebo runs by excluding Turkey from the donor pool of the placebos and the placebo distribution remains virtually unchanged.

distribution of placebo gaps. This means that, if a country had been randomly selected from the sample, the probability of obtaining a post/pre-terrorism RMSPE ratio as high as that of Turkey would be 1/43=0.0232. No control country in the sample achieves this ratio.

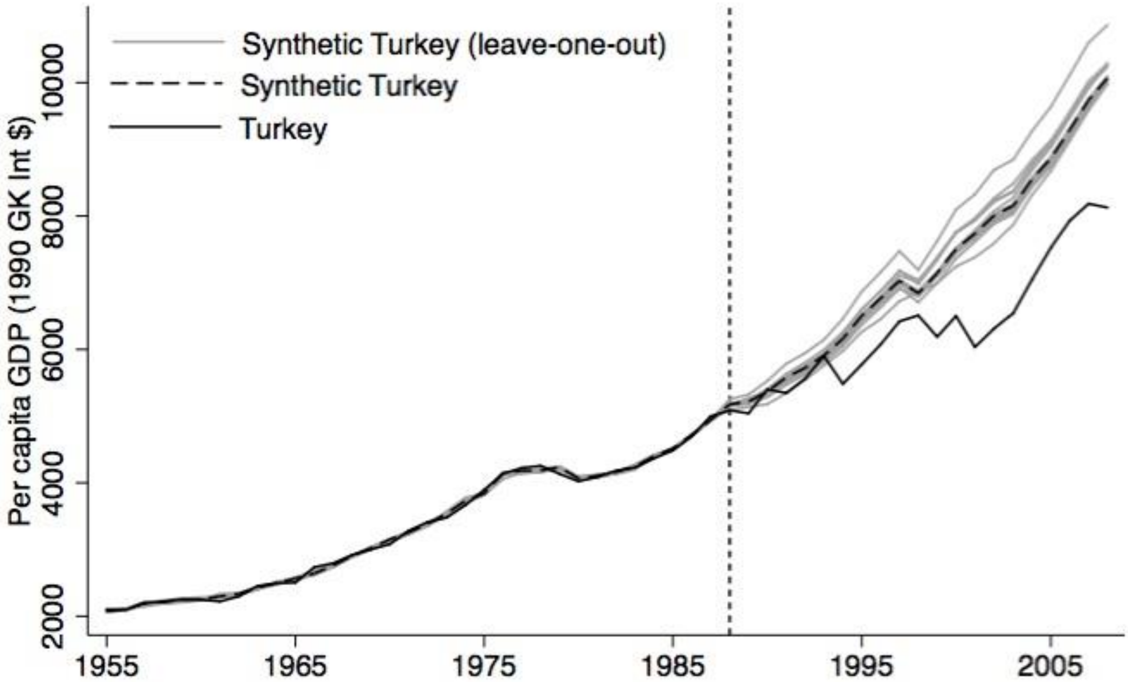
Figure 3: In-space Placebo Distributions



4.2 Leave-one-out Distribution of the Synthetic Control

We test the sensitivity of our results to the changes in the synthetic control country weights induced by the exclusion of any particular country from the sample along the lines of Abadie et al. (2015). From Table 2, the synthetic Turkey is constructed by the weighted average of fourteen countries, namely Bolivia, Comoros, Gabon, Hungary, Mauritius, Oman, Poland, Qatar, Romania, Senegal, South Korea, Swaziland, Taiwan and Venezuela. We iteratively re-estimate our model to construct a synthetic Turkey excluding in each iteration one of the countries that was assigned a weight in Table 2. We aim to assess the extent to which, our results are driven by any particular country. Figure 4 displays the results in which the black solid line is the actual real per capita GDP, the black dashed line is the synthetic Turkish GDP with all fourteen weight-assigned countries and the gray lines are the leave-one-out estimates.

Figure 4: Leave-one-out Distribution of the Synthetic Control



The average of all fourteen leave-one-out estimates of the synthetic control (gray lines) are on average 0.02 percent higher than the actual GDP of Turkey (black solid line) in the pre-terrorism period, suggesting that the leave-one-out estimates yield very good fits. In the post-terrorism period, the leave-one-out estimates of the synthetic control yield an average gap of about 14.3 percent (with standard deviation of 2.5 percent), very close to our original estimated gap of 13.8 percent. Most importantly, the average of all leave-one-out estimates of the synthetic control are only 0.42 percent higher on average, relative to our original synthetic control estimate in the post-terrorism period[15]. This suggests that the leave-one-out estimates are extremely robust to country exclusion.

4.3 Sparse Synthetic Controls

We create synthetic controls that involve a small number of comparison countries. Reducing the number of countries in the synthetic control allows us to examine the trade-off between sparsity and goodness of fit in the choice of the number of countries that contribute to the synthetic control for Turkey (Abadie et al., 2015). Accordingly, we construct synthetic controls for Turkey allowing only sequential combinations of thirteen, twelve, eleven, ten, nine, eight, seven, six, five, four, three, two, and a single control country respectively. For each $l = 13,12,11,10, \dots ,3,2,1$, we choose the one that produces the synthetic control unit that minimizes the RMSPE. Table 3 shows the countries and weights for the sparse synthetic controls and the compromise in terms of goodness of fit that results by reducing the number of countries, l, that contribute to the synthetic control. The countries contributing to the sparse versions of the synthetic control for Turkey are subsets of the set of fourteen countries contributing to the synthetic control. South Korea and Bolivia retain the largest weights in most of the cases. Relative to the original specification with fourteen weight-assigned control countries, the loss in the goodness of fit (as shown by the corresponding RMSPE in table 3 is very low for $l = 13,12, \dots ,4$. Further, the average percentage difference between the sparse synthetic Turkey and the actual Turkey is about 12.6 percent, very close to our original estimate of 13.8 percent. However, for $l = 3,2,1$, the goodness of fit values are significantly poor, showing a substantial gap between the actual and the synthetic Turkey in the pre-terrorism period.

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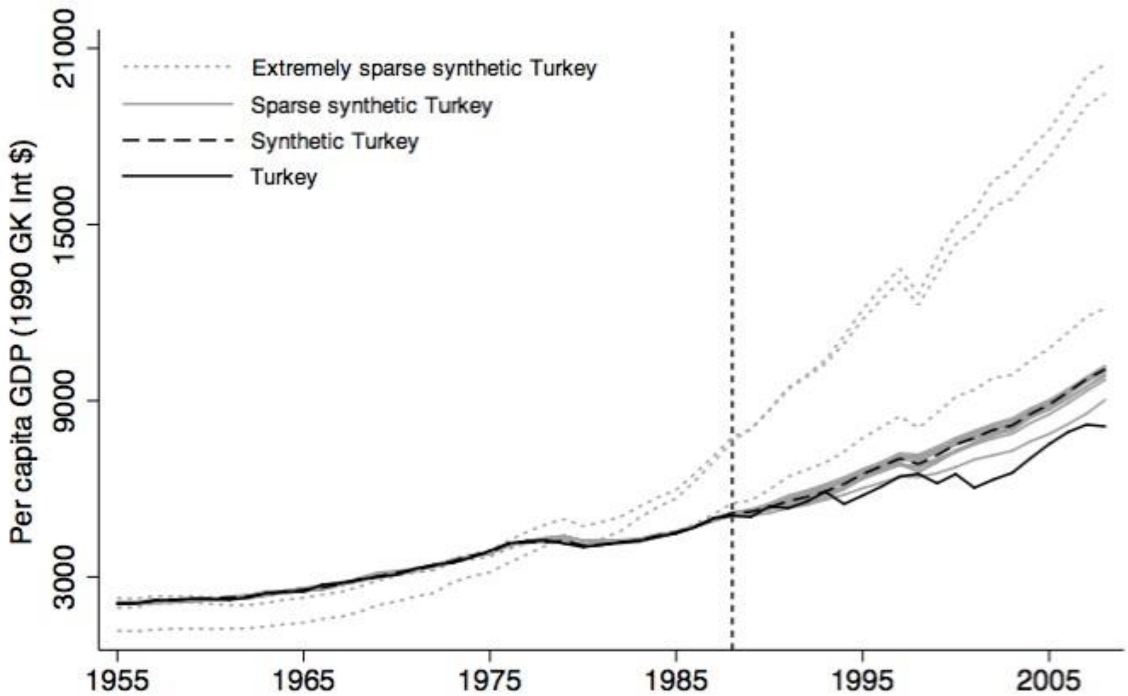
[15] While the exclusion of Oman (the highest gray trajectory in figure 4 yields the largest percentage gap in the post-terrorism period, the exclusion of South Korea (the lowest gray trajectory in figure 4 yields the smallest percentage gap.

Figure 5 shows the per capita GDP trajectory of Turkey and sparse synthetic controls with $l = 13,12,11,10, \dots ,3,2,1$. The sparse synthetic controls in figure 5 produce results that are highly similar to the original synthetic control shown in figure 2 for cases where $l > 3$. However, for $l \leq 3$, which we label *extremely sparse* synthetic controls, the pre-legislation fit begins to deteriorate.

Figure 5: Per capita GDP gaps between Turkey and Sparse Synthetic Controls



The less formal inference of the synthetic control requires a number of donor pool countries such that the assessment of the rank of the post/pre-terrorism RMSPE is statistically a valid procedure to infer whether the estimated effect can be regarded as causal. With a number of donor pool countries as many as fourteen, we are still able to obtain the highest post/pre-terrorism RMSPE for Turkey. The in-space placebo experiment would still be informative, albeit marginally, since the smallest acceptable probability of error committed for rejecting the null hypothesis of no causal effect is $1/(14 + 1) \approx 0.06$.

Table 3: Synthetic Weights from the Combination of Control Countries, Turkey

Synthetic			Country and weights												
combination	Size (%)	RMSPE	S. Korea	Venezuela	Bolivia	Romania	Mauritius	Oman	Swaziland	Qatar	Hungary	Taiwan	Gabon	Poland	Senegal
13 controls	14.4	50.28	0.130	0.053	0.161	0.049	0.146	0.059	0.110	0.002	0.000	0.097	0.019	0.075	0.100
12 controls	14.8	51.40	0.239	0.076	0.227	0.000	0.130	0.088	0.200	0.001	0.026	0.000	0.014	0.000	
11 controls	16.6	53.78	0.191	0.054	0.209	0.000	0.194	0.095	0.203	0.005	0.013	0.024	0.013		
10 controls	14.2	56.05	0.187	0.044	0.180	0.126	0.231	0.080	0.146	0.006	0.000	0.000			
9 controls	15.7	54.45	0.219	0.058	0.177	0.041	0.181	0.101	0.215	0.007	0.000				
8 controls	11.8	58.84	0.171	0.031	0.233	0.207	0.232	0.087	0.033	0.006					
7 controls	10.8	54.30	0.194	0.084	0.131	0.110	0.172	0.070	0.239						
6 controls	4.2	63.08	0.113	0.060	0.309	0.166	0.198	0.155							
5 controls	11.6	83.40	0.264	0.070	0.230	0.332	0.105								
4 controls	11.9	83.26	0.329	0.086	0.257	0.328									
3 controls	35.3	110.41	0.477	0.110	0.413										
2 controls	109.7	713.93	0.898	0.102											
1 controls	117.7	959.76	1.000												

Note: Countries and weights are constructed from the best fitting sequential combination of thirteen, twelve, eleven, ten, nine, eight, seven, six, five, four, three, two and one countries.

5. Assessment of the Threats to the Validity of Causal Inference

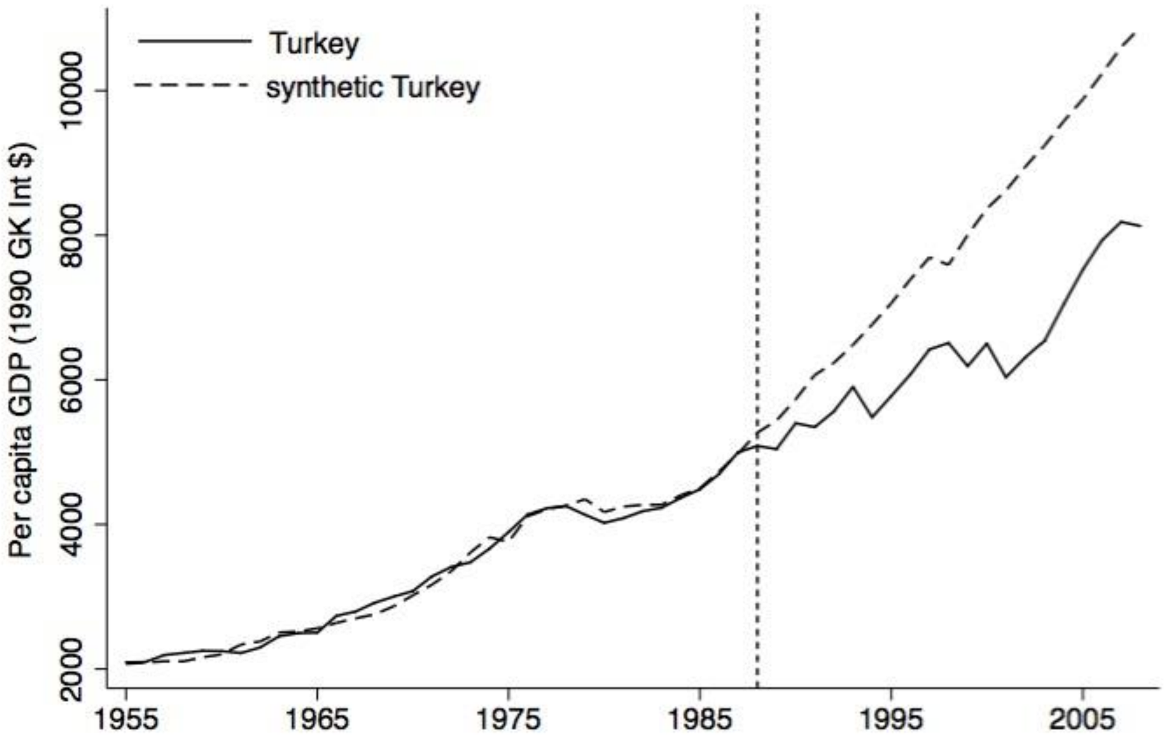
In this section, we strengthen the credibility of our findings and the validity of causal inference by assessing a number of potential threats. All of these assessments deal with the unbiasedness of the treatment effect in the following dimensions: (1) pre-terrorism predictors of GDP, (2) other interventions to the control units in the pre-terrorism period and (3) other interventions to the treated unit in the pre-terrorism period. Below, we assess each potential threat in turn.

5.1 Using non-outcome pre-terrorism characteristics as predictors of GDP

In a very recent article, Kaul et al. (2016) posits that the imputation of the counterfactual outcome in the synthetic control should never include all pre-intervention outcomes as economic predictors for the treated unit on the grounds that the non-outcome predictors become irrelevant when all pre-treatment outcomes are included, jeopardizing the unbiasedness of the treatment effect. Our prima facie argument is that using all pre-intervention outcomes as economic predictors for the treated unit is unlikely to bias our estimate. The reason is that matching on 33 years of pre-intervention per capita GDP allows us to control for heterogeneous responses to multiple unobserved factors (Abadie et al., 2015).

As an additional robustness check of our estimate, we construct an alternative synthetic Turkey, using non-outcome pre-terrorism predictors. Based on the vast literature on the cross-country determinants of GDP and economic growth, this new set of predictors includes the 1960-1987 averages of the inflation rate, fertility rate, foreign direct investment (% of GDP), government consumption ratio (% of GDP), life expectancy at birth (years), population growth rate, secondary school gross enrollment rate (%) and trade openness, measured by the total share of imports and exports (% of GDP), all collected from the World Bank, World Development Indicators[16]. These covariates are used when available at least for one year in the pre-terrorism period. To control for the initial condition and the GDP level at the treatment cutoff, we further include the pre-intervention values of the GDP, only for the years 1955, 1977, 1978 and 1987. As a result of the available data on all our non-outcome predictors, our final donor pool consists of 52 countries[17].

Figure 6: Trends in per capita GDP using non-outcome pre-terrorism predictors: Turkey vs. Synthetic Turkey



Note: The synthetic Turkey is constructed by using the pre-terrorism averages of the inflation rate, fertility rate, foreign direct investment, government consumption ratio, life expectancy at birth, population growth, secondary school gross enrollment rate, trade openness and the GDP values for the years 1955, 1977, 1978 and 1987.

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[16] World Development Indicators (WDI): http://data.worldbank.org/data-catalog/world-development-indicators

[17] We do not restrict the donor pool through the propensity scores.

Figure 6 plots the trends in per capita GDP. As a consequence of this alternative specification, the synthetic Turkey is constructed by different weights and weight-assigned control countries: Bolivia (0.014), Burkina Faso (0.284), Gabon (0.35), Ivory Coast (0.97), Kuwait (0.009), Mauritius (0.192), Saudi Arabia (0.056), South Korea (0.278) and the United States (0.035). Notice that four of these weight-assigned countries also appear as controls in our original specification (see table 2). With eight non-outcome covariates and four pre-terrorism values of the outcome, we still obtain an acceptable fit in the pre-terrorism period and a sizeable effect in the post-terrorism period, which is higher than our original synthetic control estimate by about 10 percentage points.

To strengthen our case that the synthetic control constructed by using all pre-intervention outcomes as predictors does not jeopardize the unbiasedness of the treatment effect, we next assess the sampling distribution of the causal effect and show that the expected value of the treatment effect through resampling is not drastically different from our original estimate.

5.2 Sampling distribution of the estimated effect of terrorism

In order to assess the discrepancy between the effect we found in section 4 and the expected value of the causal effect, we invoke a resampling procedure over our donor pool of 42 countries in which we perform 2000 resampling rounds (with replacement) for Turkey. In each round, we randomly draw a donor pool consisting of nineteen countries from among 42 countries and we perform placebo test for every resampling round[18]. This results in $(19 + 1) \times 2000 = 40{,}000$ estimates. For

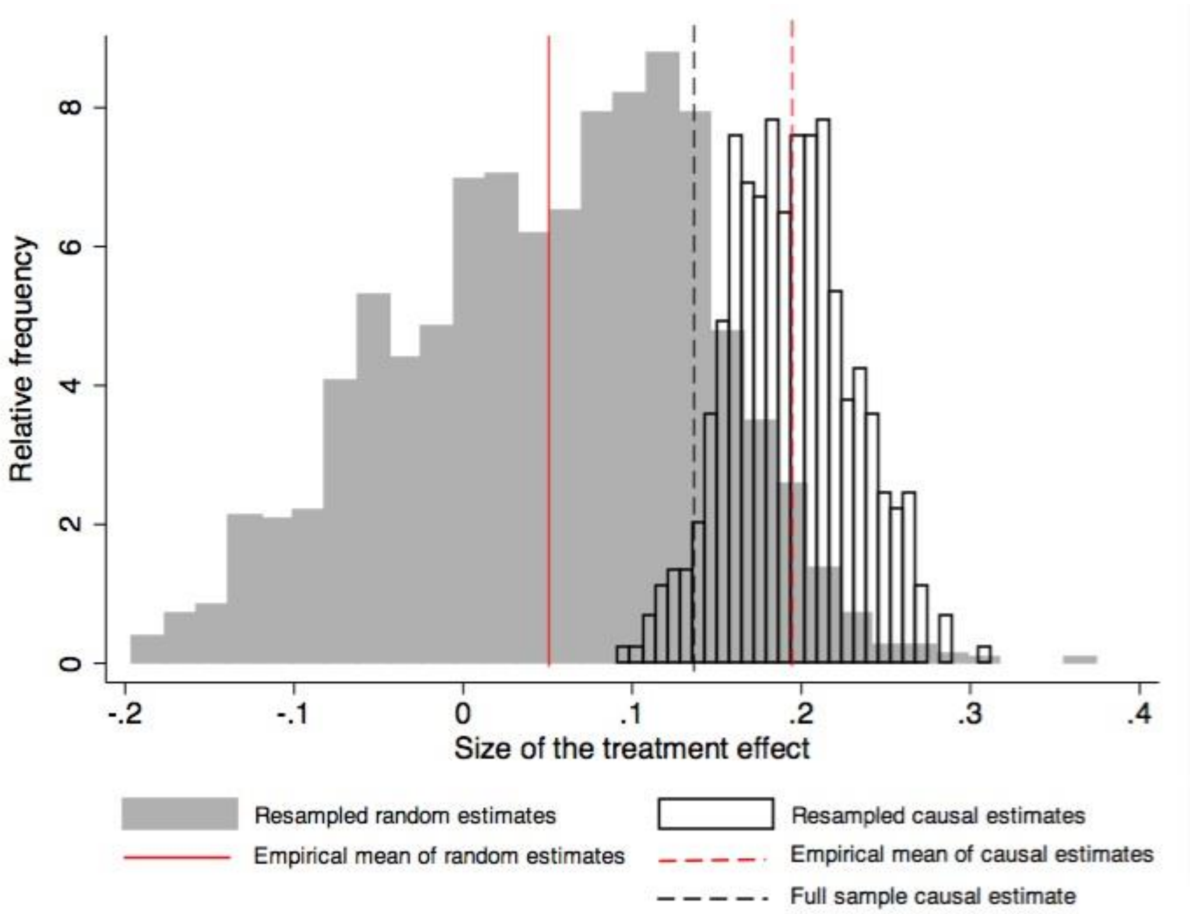
[18] We chose this number of donor pool countries based on the highest tolerable level, which we set to 5 percent $\left(\frac{1}{19+1}\right)$; the conventional significance level used to reject the null hypothesis of no causal effects.

each sampling round, we assess the distribution of the placebo effects and then plot the histogram of all treatment effects[19]. This enables us to assess the distribution of the causal effects and the location of our point estimate relative to the expected causal estimate obtained through repeated random sampling. Although probabilistic sampling is not employed to select sample units in comparative case studies, we nevertheless believe that a repeated random sampling procedure is somewhat a fair approximation to the expected value of the treatment effect.

Figure 7 shows the sampling distribution of all 2000 estimates, separately for 1552 rounds for which the treatment effect is identified to be random (i.e. the treated unit, Turkey, fails to achieve the highest post/pre-terrorism RMSPE, shown by the gray distribution) and for 448 rounds for which the treatment effect is causal (i.e. the post/pre-terrorism RMSPE for Turkey achieves the highest ratio, shown by the black-bordered distribution). While the empirical mean of resampled random estimates is 5.2 percent (the red solid vertical line in figure 7), the empirical mean of resampled causal estimates is 19.4 percent (the red dashed vertical line in figure 7). Relative to the distribution of the resampled causal estimates, our point estimate of a 13.8 percent gap between the synthetic Turkey and actual Turkey is located close to the left tail of the distribution, implying that our causal estimate is somewhat a conservative one (the black dashed vertical line in figure 7).

[19] Running all 40,000 placebos is an extremely time-consuming procedure. However, by pruning some of the rounds based on a number of indicators that would ex-ante render them impossible to pass the placebo tests, we were able to reduce the time required to perform the in-space placebo experiments by about sixty percent. For each of the 2,000 rounds, we calculate the pre-terrorism RMSPE and the post/pre-terrorism RMSPE ratio. Heuristically but with a considerable margin, we discarded all rounds for which the pre-terrorism RMSPE is higher than 90 (i.e. worse fit) and the post/pre-terrorism RMSPE ratio is smaller than 15 for they were exceptionally unlikely to pass the placebo experiments. This yields a total of 735 rounds and thus $(19 + 1) \times 735 = 14{,}700$ estimates that are likely to pass the placebo experiments. Out of these 735 rounds, only in 448, the estimated treatment effect was found to be causal.

Figure 7: Sampling distribution of the treatment effects



Note: Based on 2000 resampling rounds with 19 random draws of donor pool countries out of 42 in each round. The resampled causal estimates are those in which the treated unit obtains the highest post/pre-terrorism RMSPE in the placebo runs (# of rounds=448). The resampled random estimates are those in which the treated unit does not achieve the highest post/pre-terrorism RMSPE in the placebo runs (# of rounds=1552).

So far, we did not address the consequences of including, what may be termed as, *contaminated controls*; that is weight-assigned units in the donor pool, exposed to shocks other than terrorist events in the pre-intervention periods. If such weight-assigned control units exists, the synthetic control unit will be biased since it is constructed by their weighted linear combination. The direction of the bias depends on the relative weights and the direction of the effects of other interventions experienced by the overwhelming majority of the weight-assigned controls.

Unfortunately, there is no quick and easy fix to the problem[20]. However, although the probability of experiencing any shock is endogenous to the state of the economy, we do not have any particular reason as to expect a higher frequency of negative shocks relative to positive ones. Therefore, we argue that the sampling distribution of the estimated causal effect of terrorism may act as a safeguard against controls that might have undergone a shock in the pre-intervention periods. Each round, the randomization in the choice of the control units to be included in the donor partially absorbs the biasing effects of these shocks or interventions. Consequently, the variation in the pre-terrorism predictors of GDP due to such events is likely to have introduced, if any, a self-limited bias on the synthetic control unit.

5.3 The Economic Crisis and the Coup d'État as potential confounders

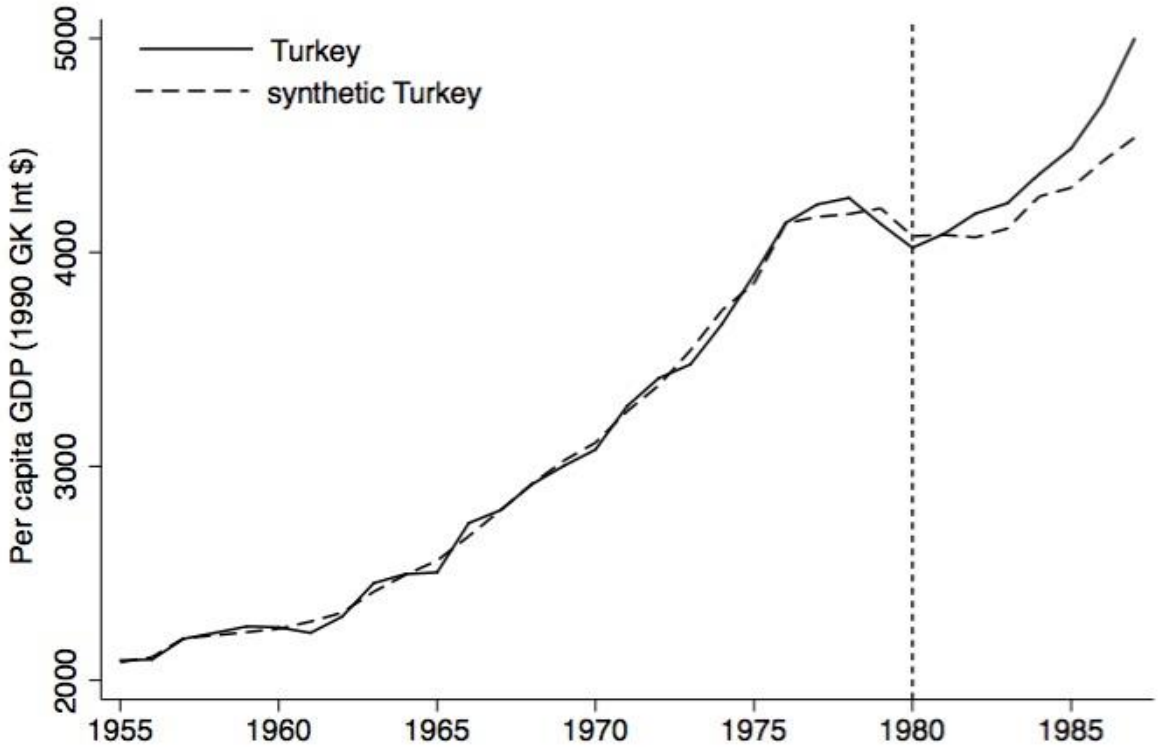
Another concern that could potentially affect the accuracy of the synthetic control is that the treated unit should not have been exposed to unit-specific interventions of a magnitude that could match the impact of PKK terrorism and that could permanently affect the GDP during the pre-terrorism period. One such case might be economic crisis of 1979 followed by the coup d'état of 1980. These events are potentially devastating for the Turkish economy due to a 77 percent devaluation of the Turkish lira and the sovereign risks implied by the military takeover and the abolishment of political parties.

[20] To the best of our knowledge, this problem is neglected in the empirical literature using the synthetic control method. On the effects of liberalization on economic development, Billmeier and Nannicini (2013) restricts the donor pool to countries in the same region as that of the treated country to capture similarities with respect to factors related to geography but does not assess the presence or the consequence of using control countries that might have undergone other interventions, potentially threatening to valid inference. As a safeguard, Horiuchi and Mayerson (2015) used only the OECD countries as the donor pool in the identification of the causal effect of second intifada on the Israeli economy. Although restricting the donor pool to the OECD members is a sensible strategy for estimating the counterfactual Israel, it cannot be used to estimate the counterfactual Turkey for most other OECD members have higher GDP trajectories than that of Turkey, placing them outside the convex-hull.

If these events have had a causal effect on the Turkish economy, this could confound the effect of PKK terrorism and our causal estimate would not be able to isolate the effect of the former from the effect of the latter. In order to rule out this possibility, we perform the synthetic control to test the null hypothesis of no causal effect of the coup d'état. If the economic crisis and the coup d'état had in fact no causal effects on the economy and hence the effect of PKK terrorism is said to be unconfounded, we should observe no drastic divergence between the actual and the synthetic GDP trajectories in the post-intervention period and fail to reject the null hypothesis of no causal effects by the in-space placebo experiment. To test this prediction, we construct our donor pool by including all 82 control countries and use the same set of characteristics used to synthetize the GDP trajectory in the baseline specification. For the fact that the economic crisis and the coup d'état outbroke consecutively, we treat them as a block intervention in 1980. The pre-coup period is 26 years (1955-1979) and the post-coup period is only 8 years (1980-1987) because of the emergence of PKK terrorism in 1988.

Figure 8 plots the trends in GDP. The pre-coup RMSPE is 40.19, indicating that the synthetic control yields a good fit. The synthetic Turkey is constructed by the weighted linear combination of eleven countries: Bolivia (0.187), Cuba (0.046), Dominican Republic (0.064), Equatorial Guinea (0.049), Gabon (0.026), Mauritius (0.040), Oman (0.043), Poland (0.063), Romania (0.243), South Korea (0.177) and Venezuela (0.062). Albeit contrary to our expectations regarding the direction of the synthetic trajectory, there is a slight gap of about 3.4 percent in the post-coup period. However, this effect, as indicated by the placebo experiments, is completely random.

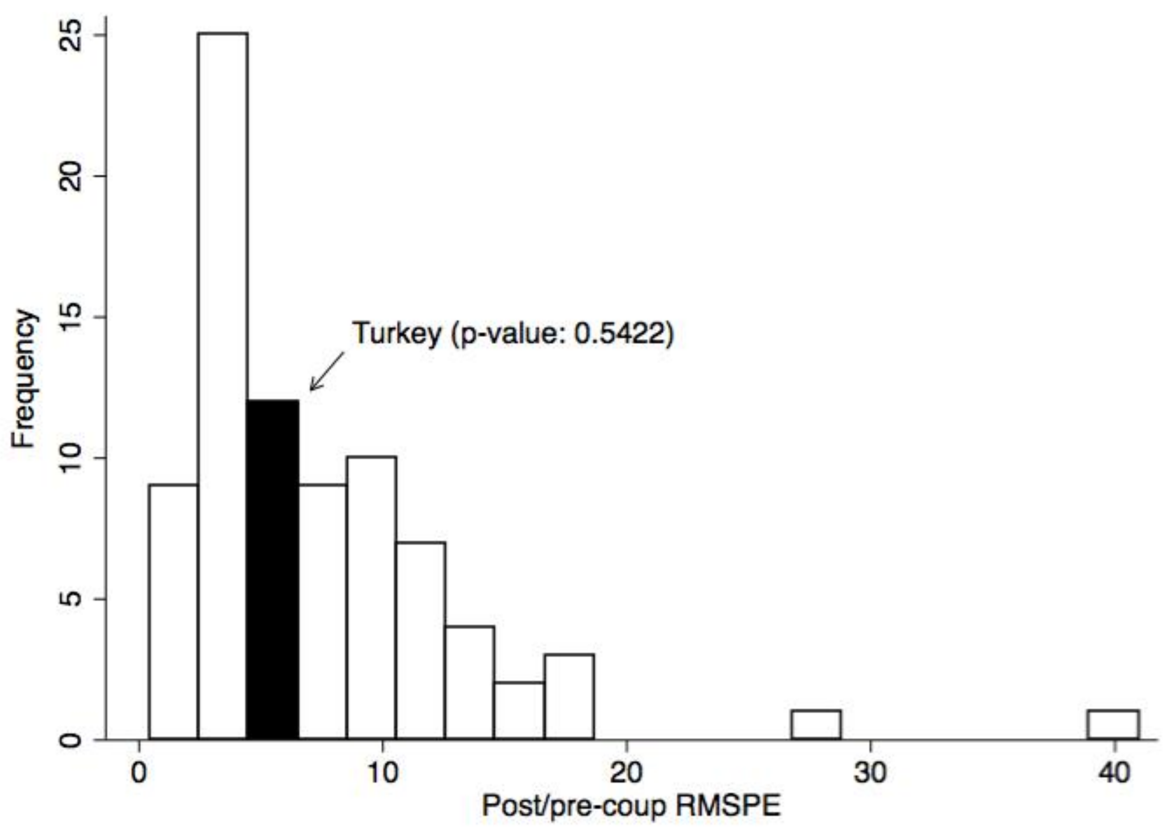
Figure 8: Trends in per capita GDP for the coup d'état of 1980: Turkey vs. Synthetic Turkey



Note: The vertical dashed line is the year of the coup d'etat. The actual and the synthetic trends end in 1987 due to the emergence of PKK terrorism in 1988.

Figure 9 plots the distribution of placebo effects for Turkey and for every 82 countries in the donor pool. The estimated GDP gap fell well inside the distribution of placebo gaps, indicating that the estimated effect is not causal. If a country would have been randomly selected from the sample, the probability of obtaining a post/pre-coup RMSPE as high as that of Turkey would be 45/83=0.5422, meaning that there are forty-four control countries that yield higher post/pre-coup RMSPE. We therefore posit that the economic crisis and the military coup had no causal effect on the economy and that the estimated causal effect of PKK terrorism is unlikely to be plagued by these events.

Figure 9: In-space placebo distributions under the coup d'état



6. Discussion

Expectedly, our estimated overall impact of 13.8 percent higher per capita GDP or a 0.62 percentage points higher annual GDP growth in the absence of terrorism is larger than that of Bilgel and Karahasan (2015) and still represents a lower bound, both statistically as well as economically. Economically, the effect of PKK terrorism on economic development has distributional foundations. In the absence of such a devastating conflict, one can well expect an efficient distribution of resources towards more productive uses. First, the priorities of the policymakers would change since both the eastern regions as well as other underdeveloped locations would demand different measures to enhance the level of economic activity and prosperity in the region in the absence of terrorism-based security issues. Second, as discussed in Kayaoğlu (2014), the enforcement of the state of emergency (SoE) has a negative impact on economic environment through forced migration, labor market conditions and human capital investment that enforces inequality and underdevelopment. In a counterfactual state with no terrorism-based security issues, SoE and similar policies would cease to exist and would create more room for local dynamics to work for a sound economic environment. Channels through which terrorism and security concerns affect economic activity range from the distribution of public funds to the reluctance of both domestic and foreign investors to engage in new business and economic activities. We take these channels as avenues for future research.

Even a final and sustainable peace atmosphere cannot be built, the cease-fire attempts, albeit discontinuous and of varying duration, usually followed by a sharp decline in the number of incidences and fatalities. However, these attempts had severe recoil. Among others, the post-1999 period and the recent developments after 2009 have been crucial. After the capture of Abdullah Öcalan in Kenya, the direct events of PKK ceased and the number of fatalities fell drastically between 1999 and 2002. A second important milestone, so called the solution process (*çözüm süreci*), started in 2009. The solution attempts involved not only PKK but also political actors, individuals and institutions from the civil society. During this period, the number of incidences and fatalities once more fell drastically, however a long-lasting solution to the conflict cannot be sustained. Bilgel and Karahasan (2015) underlines that for the post-2000 period there is almost no change in the origins and the overall structure of separatist terrorism in Turkey.

We implement the synthetic control analysis for the 1955-2008 period for the reasons outlined in the data section and therefore could not extend our estimate for the post-2009 period during which one of the most significant cease-fires had been declared.

However, the inability to establish a credible cease-fire once more resulted in rising terrorist activities in the same geography. The re-emergence of terrorism, as Bilgel and Karahasan (2015) notes, is both location- and impact-independent for Turkey.

With the end of the cease-fire after June 2015, the majority of the incidences outbroke in the eastern and southeastern regions of Turkey. Unlike the previous implementations of SoE, a new statute called Special Security Areas (*Özel Güvenlik Bölgesi*) went into effect with massive curfew order. One notable difference of the post-June 2015 is the rise in the number of activities and incidences in the residential central areas of eastern and southeastern regions rather than historically predominant incidences in the rural areas. In both cease-fire rounds, we have no reason to suspect that these events would have attenuated our estimate if our sample period had been extended until 2015.

7. Conclusion

We use country-level panel data on per capita GDP for the period of 1955-2008 to isolate the economic effects of PKK terrorism in Turkey. For this purpose, we invoke the synthetic control method to impute how the Turkish per capita GDP would have behaved in the absence of PKK terrorism. Extended over a period of twenty-one years (1988-2008), we find that Turkey could have enjoyed a 13.8 percent higher per capita GDP had it not been exposed to PKK terrorism. Using the latest Bureau of Labor Statistics inflation information provided in the consumer price index, this amounts to an average per capita gap of about $1,585 (in 2015 dollars) or 0.62 percentage point higher annual growth in the absence of terrorism. Through in-space placebo studies, we show that our estimated effect is caused by the emergence of PKK terrorism. Our estimate is extremely robust to iterative country exclusion as well as to the use of a number of control countries as small as four. To increase the credibility of our findings, we show that the estimated effect does not alter drastically when non-outcome characteristics were used as predictors of GDP instead of preintervention outcome values.

We next assess the unbiasedness of our estimate by conducting a Monte Carlo experiment and find that the empirical mean obtained through repeated random sampling, as a fair approximation to the expected value of the treatment effect, is not different to the extent of rebutting our estimate. Further, the resampling procedure is argued to act as a safeguard against the biasing effects of weight-assigned control units that may have been exposed to terror-unrelated interventions in the pre-terrorism period. Finally, we provide evidence in favor of the argument that the pre-terrorism shocks to the Turkish economy do not confound our estimated effect for the effects of these interventions cannot be deemed causal.

Given the continuum of separatist terrorism during the last three decades, several studies discussed the different dimensions of the conflict. Our approach departs from the literature not only by identifying the true causal impact of terrorism but also pointing out the annual and overall size of the economic cost of the conflict for the Turkish economy. Our findings suggest that sizable social and political measures are imperative to bring an end to the conflict as past experiences indicate that each peace attempt brings stability. But without full commitment, each peace phase ends with progression of violence and instability. What remains behind is the prosperity and economic development.

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